

SUGARBEET DISEASE CONTROL

I. Seedling Diseases

When done properly, seed treatment protects the seed from Pathogenic fungi associated with the seed. Otherwise, spores of these fungi adhere to the seed. When the seed is planted, these pathogenic fungi begin to grow, invade the seed or seedling, and cause a seedling blight. Other fungi live in the soil and may cause seedling problems. Soil-borne Pythium, Aphanomyces and Rhizoctonia fungican cause serious stand loss when the soil is moist or wet.

Tachigaren seed pelleting is highly effective against Pythium at lower rates and Aphanomyces at higher rates. Tachigaren persists for only 3-4 weeks and will provide protection only for the emerging seedling; it does not provide protection against mid-season infection. For season-long management of Aphanomyces, the best approach is to apply Tachigaren to varieties with partial resistance to Aphanomyces. Early planting and good drainage may also help reduce early season losses from Aphanomyces seedling disease.

Tachigaren is not effective against Rhizoctonia, so an Aphanomyces soil test is important to determine what management practices to use.

II. Leaf Spots

There are various leaf spot diseases of sugarbeets. Cercospora leaf spot is the most common and destructive disease in this area. The severity of Cercospora varies from year to year depending on weather conditions, inoculum potential, and varietal resistance. Cercospora can cause losses in susceptible varieties through reduced tonnage, reduced percent sucrose, increased impurities and poorer storage after harvest when the beets are in the pile. Even fairly low levels of leaf spot may cause these effects. Cercospora leafspot disease severity were very high in 1998 and 1999, moderate in 2000, and low in 2001. Bacterial leafspot may develop in wet weather; no fungicide is registered for its control.

Leafspot Management. **Management of Cercospora requires an integrated approach which includes early incorporation of infected debris, crop rotation, use of varieties that are less susceptible, disease scouting, timely application of fungicide, adherence to appropriate application intervals and more frequent applications when disease conditions are favorable.** Avoid planting next to last year's beets. This is especially important if last year's fields had high levels of Cercospora. In high risk situations, select approved varieties that are less susceptible than the average. Begin checking for Cercospora in late June or early July, making sure to check near last year's fields or shelter belts. The first fungicide application should occur when conditions first favor disease or at disease onset.

If the first application is late, control will be difficult all season, even if shorter than normal application intervals are used once applications start. When conditions favor disease, or disease is already prevalent, fungicide applications must be more frequent than when disease pressure is low.

Resistance and Tolerance to Fungicides. The terms "resistance" and "tolerance" are often used interchangeably. However, in the following discussion they are used with specific different meanings. Resistance is used to indicate that the *Cercospora* fungus is unaffected by a level of fungicide that previously prevented growth in the laboratory. Tolerance is used to indicate that growth of the *Cercospora* fungus is reduced in the laboratory by a level of fungicide that previously prevented growth in the laboratory. Resistant strains of *Cercospora* are not controlled by field applications of a fungicide. **If tolerant strains are present, a reduced level of control will occur.**

The systemic fungicide thiophanate methyl (Topsin M) has federal registration for *Cercospora* control, and is in the benzimidazole class of fungicides. It is not recommended for use as a **stand-alone** fungicide in 2002 because the *Cercospora* fungus has developed resistance to this class of fungicide throughout all of North Dakota and Minnesota. This fungicide can be used in a tank mix with mancozeb or TPTH, but only once in a season. If used, the benzimidazole-mancozeb tank mix should be used as the first or second fungicide application.

Benzimidazole (Topsin M) resistant strains, grow normally in the laboratory in the presence of 5 ppm of benzimidazole fungicide. Sensitive strains do not grow at all in the presence of 5 ppm of benzimidazole fungicide. **Benzimidazole resistant strains and TPTH tolerant strains were common and widespread in**

Minnesota and North Dakota in 2000. Some strains of the *Cercospora* fungus have been found that were resistant to the benzimidazole fungicides and tolerant to TPTH.

Experience has shown that resistant strains of *Cercospora* increase in number and this renders systemic fungicides ineffective where applied. The resistant strains may compete well with sensitive strains, so the population of benzimidazole-resistant strains may not diminish readily following use of an alternative fungicide.

Strains of *Cercospora* with tolerance to TPTH were confirmed for the first time in southern Minnesota and the southern Red River Valley in 1994. Tolerance was detected in fields where control was not as good as expected. Such tolerance is difficult to distinguish from inadequate application technique or a late start in application. Tolerance is best defined as an ability of the fungus to grow in the laboratory in the presence of TPTH at 0.2 ppm (part per million) or at 1 ppm. Sensitive strains do not grow at all when subjected to these levels of TPTH, but tolerant strains grow at a reduced rate compared to growth in the absence of TPTH. Tolerance is incremental and progressive, and the percent of fields with tolerance to the 0.2 ppm in 2000 was very high in southern Minnesota and the southern Red River Valley and high in the northern Red River Valley, making *Cercospora* management more difficult.

Managing Cercospora Leaf Spot with Fungicides. (P.S. Eminent and Headline can only be used for the 2002 sugarbeet crop if they are granted registration by the EPA) In the southern Minnesota, Minn-Dak, and Moorhead factory districts, the fungicides Eminent, Headline, and TPTH, used in rotation, will effectively

control *Cercospora* leaf spot.

In the Hillsboro, Crookston, East Grand Forks, and Drayton factory districts, the fungicides Eminent, Headline, TPTH, and a tank-mix of Topsin M and Mancozeb, used in rotation will effectively control *Cercospora* leaf spot.

The first fungicide application should be Headline or Eminent.

If aerial application is made, make sure that areas around power lines and trees are side-dressed by the aerial applicator or by use of ground equipment. Aerial applicators should use a minimum of 5 gal solution/A; 7-10 gal/A gives better coverage. Improperly sprayed areas become focal points for *Cercospora* spread. Use 20 gal solution/A for ground applicaiton.

Preharvest Intervals. The preharvest interval (PHI) or waiting period before harvest is 21 days for Agri Tin, and Topsin M, 14 days for mancozeb and maneb, 14 days for Eminent (if available under a section 18), 7 days for Super Tin and Headline, and 0 days (no waiting period) for the copper fungicides and Quadris. Fungicides may be needed well into September in some years; stopping application of fungicides before this time may result in late-season damage that can reduce tonnage, sucrose and quality. Do not allow the PHI to be an excuse for missing an application late in the season. It may be preferable to spray a field leaving the headlands and a strip in the middle unsprayed, allowing pre-pile harvest in these areas.

Variety Selection and Cercospora Management. There are differences in *Cercospora* susceptibility among approved varieties. *Cercospora* may be somewhat easier to manage on varieties with higher than average tolerance to *Cercospora*. Conversely, varieties that are more susceptible than the average may need an extra spray in years that are highly favorable for *Cercospora*. Use of more tolerant varieties can be an important part of an integrated disease management plan.

Fungicide Rates. The benzimidazole fungicide Topsin M should be applied at ½ lb/A in a tank mix with mancozeb at 2 lb/A. Mancozeb or maneb should be applied at 2 lb/A. TPTH should be applied at 5 oz/A. Eminent should be applied at 13 fl. oz./A. Headline should be applied at 9 fl. oz./A.

Application Intervals. Generally, the application interval for most of the fungicides recommended is 14 days. In southern Minnesota, an application interval of 10-14 days may be used after the application of TPTH when weather conditions are very favorable for disease development, when *Cercospora* levels are already high or when heavy rainfall washes off product and reduces fungicide residual and activity.

Spray Coverage. Total coverage of sugarbeet plants with fungicide usually provides the best protection from diseases. A technique has been developed to measure the spray coverage on plant leaves with the use of fluorescent dye, a CCD camera, and a computer programed with the appropriate software to determine area of

coverage. This method is used to compare the coverage efficiency of various types of spray equipment. Several applicators have been studied including conventional sprayers, air assist sprayers and spray planes. Air-assist sprayers have shown slightly improved application efficiency (1-2%) as compared to conventional sprayers at equal application rates. Most ground sprayers show improved coverage over aircraft of about 16-17% but the application rate for ground sprayers is usually much higher than for aircraft.

The concept of redistribution of spray deposit on the leaf surface indicates that moisture condensation (dew) on the leaf surface resuspends some of the deposit and causes the fungicide to spread across the leaf. Also, condensation occurring during future evenings dissolves or suspends minute amounts of fungicide, spreading it further. This concept is probably more helpful for spray planes as their application rate is usually less.

III. Powdery Mildew

Powdery mildew may occur first in the southern Minnesota beet acreage, or it may develop first in the Red River Valley. The spread may be spotty, depending on the time of infection and weather conditions. When mildew occurs in late July or early August, we might expect some crop loss. Late occurring mildew (September) would not be expected to cause a measurable crop loss. Eminent provides good powdery mildew control, so mildew is not likely to be a problem if we have a section 18 for Eminent. If we do not, the sulfur fungicides give very good, quick control. Apply sulfur as soon as mildew appears, if it develops prior to mid-September.

There are differences in the labeled amounts of active ingredients per acre (ai/A) for the various sulfur products. The ai/A is noted in the table. Although North Dakota and Minnesota data are not available on how much sulfur is needed for powdery mildew control, data from California indicates that 8-10 lb ai/A gives excellent control for 4 weeks; 2-4 lb ai/A gives moderate or partial control for 4 weeks. If powdery mildew appears by mid- to late-August, 8-10 lb ai/A is advisable and a product should be selected with a label that allows these rates. If powdery mildew appears after mid- to late-August, but before mid-September, then lower rates may provide satisfactory control at reduced costs.

IV. Note

Other fungicides may be registered or currently recommended products be dropped from registration. Therefore, be sure to check the product label for registered use on sugarbeets. For rates and intervals of application, follow the directions on the label. More detailed information is available in past *Sugarbeet Research and Extension Reports*.

For leafspot control, use higher label rates and shorter label application intervals when disease is severe or weather favors rapid disease buildup on susceptible varieties. Use 5-10 gals. water by airplane. Best results with ground equipment are obtained by using high pressure (100-150 psi) and high volume. Label rates vary

considerably for recommended gallonage with ground equipment. Research trials indicate that 20-40 gal. is adequate when high pressure is used.

**FOLIAR SPRAYS
LEAFSPOTS**

Fungicide and Cost	Label Rate	Harvest Restrictions	Interval of Application
Azoxystrobin			
Quadris \$/A= 13.08-14.53, 6.2 fl oz 120.25-22.50, 9.6 fl oz	9.2-15.4 fl oz/A	May be applied up to harvest	Do not make more than 2 sequential applications or more than 6 total applications. Most research trials with Quadris have been at the 9.6 fl oz rate.
Benzimidazole Class			
Topsin M WSB \$/A (tank mix) = 12.60-13.63 high rate	1/2 lb/A	Do not apply within 21 days of harvest	Resistance to benzimidazole fungicides is common. Use <i>only</i> in a tank mix with a protectant. Do not exceed 1 application/year. Make follow up application of a different class of fungicide within 10-14 days. See text.

**FOLIAR SPRAYS
LEAFSPOTS**

Fungicide and Cost	Label Rate	Harvest Restrictions	Interval of Application
Mancozeb			
Dithane DF Rainshield	1.5-2 lb/A	Do not apply within 14 days of harvest.	Repeat every 7-10 days. Do not enter treated areas within 24 hours without protective clothing. Do not exceed 11.2 lb ai/A per season of total EBDC (mancozeb and/or maneb) <i>i.e.</i> do not exceed 14 lb/A of formulated WP or DF or 11.2 qt/A of formulated flowable
Dithane F-45	1.2-1.6 qt/A		
Dithane M-45	1.5-2 lb/A		
Manex II	1.2-1.6 qt/A		
Manzate 75 DF	1.5-2 lb/A		
Penncozeb	1.5-2 lb/A		
Penncozeb DF	1.5-2 lb/A		
\$/A ^a =			
4.45-5.20 W			
4.68-6.70 F			

Fungicide and Cost	Label Rate	Harvest Restrictions	Interval of Application
Mancozeb + Copper			
ManKocide \$/A ^a = 8.10-21.15	2.5-6.5 lb/A	Do not apply within 14 days of harvest. Do not feed treated tops to livestock.	Do not exceed 74.66 lbs/crop/season.
Maneb			
Maneb 80	1.5-2 lb/A	Do not apply within 14 days of harvest.	See remarks under mancozeb.
Maneb 75DF	1.5-2 lb/A		
Manex \$/A ^a = 4.50-6.30 W 4.76-6.34 F	1.2-1.6 qt/A		

Fungicide and Cost	Label Rate	Harvest Restrictions	Interval of Application
Maneb + Triphenyltin Hydroxide (TPTH) Tin-Man	1-1.8 qt/A	Do not apply within 21 days of harvest.	Restricted use pesticide. Repeat every 10-14 days. Do not enter treated fields within 48 hours of treating without protective clothing. Do not exceed 6 qt/A per growing season. Ground application must be with closed cabs.
Blite Out Plus \$/A ^a = 7.38-13.28	1-1.8 qt/A	Do not graze or feed treated tops to livestock.	

**FOLIAR SPRAYS
LEAFSPOTS**

Fungicide and Cost	Label Rate	Harvest Restrictions	Interval of Application
Triphenyl Tin Hydroxide Super Tin 80WP Super Tin 4L, Agri Tin /A \$ ^a = 4.41-9.42	2.5-5 oz/A	Do not apply Agri Tin and Super Tin 4L within 21 days of harvest, and Super Tin 80 WP within 7 days of harvest. Do not graze or feed beet tops to livestock.	Restricted use pesticide. Repeat every 10-14 days. Do not enter treated fields within 48 hours of treating without protective clothing. Do not exceed 15 oz/A of TPTH 80 WP per season. Ground application must be with closed cabs. Tolerance to Triphenyl Tin Hydroxide is common in Southern Minnesota and in the southern Red River Valley. See text.

POWDERY MILDEW

Fungicide and Cost Sulfur	Label Rate Formulated Product (lb ai/A)	Harvest Restrictions	Remarks
Micro Sulf 80%	5-10 lb/A (4-8 lb ai)	Can be used up to harvest	One application gives protection for 4 weeks.
Microthiol Disperse 80%	5-10 lb/A (4-8 lb ai)		
Super Six	8 pt/A (6 lb ai)		
Thiolux (DF)	10-20 lb/A (8-16 lb ai)		
\$/A ^a = 4.30-8.60 (4-8 lb ai)			

^a Cost for one application using list prices (prices may be slightly higher by summer).
D = dry flowable, F = flowable, W = wettable powder

The following shows experimental and registered fungicides used for controlling Cercospora leaf spot and their class of chemistry:

Strobilurins

Quadris
Gem (USF 2004)
BAS 500 (Headline)
Stratego (Flint+Tilt)

Sterol Inhibitors

Eminent
RH-7592
Stratego (Tilt + Flint)

Ethylenebisdithiocarbamates (EBDC)

Maneb
Mancozeb
Manzate
Penncozeb

Benzimidazole Triphenyltin Hydroxide (TPTH)

Topsin M
SuperTin
AgriTin

PS: Products must be labeled before they can be used for controlling Cercospora leaf spot on sugarbeet.

